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## Grazing and Haying-Effects on Habitats of Upland Nesting Birds

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### Introduction

Under pristine conditions, the major factors that influenced grassland ecosystems were fires, activities of wild herbivores, and climatic variations. In practicing the art of wildlife management, man has attempted to simulate some of the ecological forces that prevailed in natural ecosystems to manipulate vegetation for habitat management. Grazing by domestic livestock and hay mowing are two agricultural practices that have been widely used to manage plant communities in upland habitats on wildlife management areas.

For many years, there has been controversy over the proper role of grazing and haying for the management of habitats of upland nesting birds. Grazing and haying can drastically alter the amount and composition of the vegetation available for birds. Relationships of grazing to wildlife populations are difficult to define because grazing often varies so much in intensity, time, and distribution. In this paper, we discuss some of the ways that grazing and haying may affect the distribution, abundance, and productivity of dabbling ducks, gallinaceous birds, and other birds that nest in upland habitats. It is apparent that the welfare of wildlife populations is intricately related to the quantity and quality of habitats required for their maintenance. We agree with Komarek (1969) that the manipulation of vegetation to influence animal populations is the basis of wildlife habitat management. However, there have been differing opinions among wildlife managers and administrators about how, where, and when manipulations should be used. We believe this is, in part, because most current grassland management techniques have been developed primarily for the maximum production of livestock. Yet habitat requirements of upland nesting birds may require quite different management regimes. Although there is considerable evidence that *annual* cover removal on upland habitats by grazing or haying is detrimental to the production of most upland nesting birds; *periodic* treatments to remove cover on designated areas by fire, grazing, or mowing may be desirable for the long-term maintenance of upland nesting habitats in their best ecological condition. This paper pertains primarily to upland and wet-meadow habitats in the glaciated prairie and cold desert regions of the northwestern quarter of the United States.

### Review of Literature

#### Upland Nesting Ducks

Residual vegetation is an important habitat factor in nest site selection for many species of waterfowl in a wide variety of vegetative types. Leopold (1933) pointed

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out that most of our waterfowl and all of our gallinaceous birds depend upon residual vegetation for initial nesting attempts. Bue et al. (1952) reported that nearly all duck nests found in western South Dakota were in the tallest, most dense cover available. In Oregon, Clark (1977) found that densities of dabbling duck nests were highest on units where grazing and mowing were prohibited. He also reported that density of residual cover was the single best habitat parameter for distinguishing nest sites from random (presumably non-nest) sites. Gjersing (1975) found that waterfowl pair populations and brood numbers increased in Montana with increases in residual vegetation. In Utah, Hilliard (1974) found that waterfowl chose nest sites with taller vegetation than that generally available within the study plots, and nesting on the study plots tended to decrease with increased grazing pressure. Martz (1967) studied the effects of cover removal on nesting by dabbling ducks in North Dakota and found an average of 22 nests per 100 acres (40.5 ha) on mowed blocks compared with 36 nests per 100 acres on unmowed blocks. In Montana, Mundinger (1976) found the greatest density of duck pairs on grasslands that were ungrazed during the previous growing season and had residual vegetation. Oetting and Cassel (1971) reported significantly more nests in unmowed blocks as compared with mowed blocks on an interstate highway right-of-way in North Dakota. Their data showed that numbers of hatched nests of mallards (*Anas platyrhynchos*), gadwalls (*A. strepera*), and pintails (*A. acuta*) was five times higher on the unmowed than on the mowed plots. In Utah, Murdy (1953) found a direct positive relationship between duck nest density and saltgrass (*Distichlis stricta*) height and an inverse relationship between nest density and the degree of utilization by cattle. Similarly, Reeves (1954), also working in Utah, found that ducks, particularly mallards, avoided heavily grazed areas for nesting. Salyer (1962) reported that more duck pairs were found in ungrazed areas than in those moderately or lightly grazed. Sowls (1955) reported that ungrazed marsh meadows formed the most important and productive nesting cover at Delta, Manitoba. This habitat type made up 14 percent of the study area and accommodated 87 percent of the nests. Wheeler (1972) found 5.0 successful duck nests per 100 acres (40.5 ha) on game management areas with undisturbed cover compared with 2.6 per 100 acres on tame hayland and 0.9 on pastures. Drewien and Springer (1969) reported that South Dakota ponds located in Soil Bank fields with undisturbed grass or grass-legume cover, idle areas, and hay fields received considerably higher use by breeding pairs than ponds in cultivated fields or pastures. The extreme importance of residual vegetation in nest site selection by dabbling ducks is well documented in the literature. The effects of grazing and mowing on reducing the quantity of residual vegetation is generally implied but not clearly stated in most of these studies.

The effects of grazing and haying upon duck nesting success are not so clear in the literature, but the importance of residual cover is usually indicated. In Iowa, Burgess et al. (1965) concluded that moderately grazed grasslands were more attractive to blue-winged teal (*Anas discors*) than ungrazed grasslands, but other duck species showed less tolerance to grazing. Glover (1956) also in Iowa, concluded that more waterfowl would nest and a greater number of those nests would be successful if they were located in lightly grazed or ungrazed bluegrass and sedge-meadow areas. In another Iowa study on this same area, Heiser (1971)

found that blue-winged teal showed a preference for dense cover and most successful nests were in tall, dense vegetation with deep litter. Krapu et al. (1970) also in Iowa, reported on a study of simulated duck nests in three grassland treatments. Success was 10 percent on the area grazed in the current year, 17 percent on the area left ungrazed for 1 year and 30 percent on the area that had been ungrazed for 5 years. In a study at Monte Vista National Wildlife Refuge, Colorado, Enright (1971) concluded that grazing was beneficial to duck production in that area, where black rush (*Juncus balticus*) was the principal nesting cover. Capel (1965) studied relationships between grazing and predator activity in four types of waterfowl nesting cover by the use of simulated nests in North Dakota. He found that the proportion destroyed by predators averaged 49 percent in grazed habitats and 43 percent in idle habitats. In a South Dakota study, Kaiser (1976) found a waterfowl nest density of 12.5 acres (5.1 ha) per nest in ungrazed native plant communities compared to 21.2 acres (8.6 ha) per nest in grazed native plant communities. Nest success was higher on the grazed areas (46.7 percent) than on the ungrazed areas (29.5 percent). Keith (1961) found that dense vegetation developed in the absence of grazing was very attractive to nesting waterfowl on his Alberta study area. On grazed habitats, 35 percent of the nests hatched and on two ungrazed areas hatching success was 38 percent and 22 percent. A study by Kirsch (1969) in North Dakota, indicated higher densities and higher success for duck nests on ungrazed than grazed upland habitats. On grazed plots, the average nest density was 0.17 per acre and the average nest success was 14 percent. On ungrazed plots, the average nest density was 0.28 per acre and the average nest success was 28 percent. In Ladd's (1969) evaluation of relationships of predation and land use to duck nesting on Valentine National Wildlife Refuge in Nebraska, the survival of simulated duck nests was 33 percent in non-use habitat and 60 percent in fall and winter grazed areas. He also determined the number of natural nests per 100 acres (40.5 ha) for four land use treatments as: non-use 0.9, fall and winter grazed 7.2, summer grazed 5.2 and mowed 7.2. Miller (1971) summarized duck nesting success on several study areas in North and South Dakota. On idled habitats, 44 percent of the nests hatched, compared with 27 percent on grazed habitats and 29 percent on mowed habitats. Moyle (1964) reported that more nests were found in Soil Bank land with undisturbed grass-legume cover and that the proportion of successful nests was higher than in any other cover on the Minnesota study areas. Schranck (1966) investigated simulated nest survival as a measure of predator activity in three cover densities on national wildlife refuges in North Dakota. Survival was 76 percent in heavy cover, 60 percent in medium cover, and 21 percent in light cover. Jarvis and Harris (1971) found 28 percent hatching success for ducks in the portion of the study area which had the most residual cover compared to 19 percent in mowed areas with less residual cover in Oregon.

Labisky (1957) found that 78 percent of mallard and blue-winged teal nests in alfalfa fields were destroyed by haying operations at the Horicon National Wildlife Refuge in Wisconsin. In addition to causing direct mortality to eggs, young, and hens, haying removes the residual vegetation needed for next year's nesting. This effect was documented in studies reported by Moyle (1964) and Oetting and Cassel (1971).

### *Upland Game Birds*

Most species of upland game birds have a strong preference for nesting cover with an abundance of residual vegetation. The importance of undisturbed grassy or grassy and herbaceous habitat to production of ringnecked pheasants (*Phasianus colchicus*) has been pointed out by numerous authors including: Bartmann (1969) in Utah, Baskett (1947) in Iowa, Dahlgren (1967) and Elliott and Linder (1972) in South Dakota, Gates et al. (1970), and Frank and Woehler (1969) in Wisconsin. Gates et al. (1970) also reported that no form of cover removal is compatible with maintenance of optimum nesting cover for pheasants.

Nesting and brood-rearing activities of prairie chickens (*Tympanuchus cupido*) and sharp-tailed grouse (*Pedioecetes phasianellus*) are greatly influenced by annual grazing or haying which reduce the quantity of residual cover. The importance of abundant residual cover to prairie chickens and sharp-tailed grouse is adequately documented in the literature by Yeatter (1963) in Illinois, Kirsch et al. (1973) in North Dakota, Schwartz (1945) and Christisen (1969) in Missouri, Brown (1966) in Montana, Jones (1963) in Oklahoma, Lehmann (1963) in Texas, and Viehmeyer (1941) in Nebraska.

Periodic prescribed burning has been used successfully in maintaining grassland in a highly productive condition for prairie chickens. In Illinois, Westemeier and Vance (1972) reported that prescribed burning played a significant role in dramatic prairie chicken population increases. Others recognizing the importance of fire in maintaining habitat in the proper successional stage for prairie chickens include: Grange (1949), Ammann (1957), Westemeier (1971), and Miller (1963). Kirsch (1974) recommended prescribed burning at 3- to 5-year intervals as a method for maintaining productive prairie chicken habitat.

The sage grouse (*Centrocercus urophasianus*) in Idaho selects nesting areas of plant cover more dense than normal and nest sites are located where the percentage of litter is highest (Klebenow 1969).

Klimstra and Roseberry (1975) found bobwhite (*Colinus virginianus*) nest densities about three times higher in idle fields than in either pasture or hay fields in Illinois. They also observed the highest nest success in idle fields.

### *Nongame Birds*

Nongame birds which nest in upland areas are also influenced by the amount and quality of available vegetation. Wiens (1969) suggested that residual vegetation may be especially important in the habitat preferences of ground-nesting grassland birds. Some studies are available showing the influence of haying and grazing on nongame birds. One by Owens (1971) compared pairs of native passerine birds per 100 acres (40.5 ha) on undisturbed, hayed and grazed grasslands in Alberta. The highest pair density, 54 per 100 acres, was on undisturbed grasslands followed by 40 on hayed and 28 on grazed. Owens also found that grazing and haying completely eliminated some species while increasing others.

Kirsch and Higgins (1976) studied upland sandpiper (*Bartramia longicauda*) nesting in grazed, prescribed burned, and undisturbed mixed grass prairie in North Dakota and found nest success of 71 percent in the burned and undisturbed prairie compared with 48 percent in the grazed prairie. Nests hatched per 100

acres (40.5 ha) were five times higher in the burned habitat than in the grazed habitat and two times higher in the undisturbed habitat than in the grazed habitat.

Owens and Myres (1973), in a southern Alberta study, found that disturbance of a native fescue (*Festuca scabrella*) grassland by mowing or cattle grazing reduced or eliminated populations of Baird's sparrow (*Ammodramus bairdii*) and Sprague's pipit (*Anthus spragueii*); did not affect the populations of savannah sparrow (*Passerculus sandwichensis*), clay-colored sparrow (*Spizella pallida*) or western meadowlark (*Sturnella neglecta*); and permitted the ingress of horned lark (*Eremophila alpestris*) and chestnut-collared longspur (*Calcarius ornatus*). Overmire (1963), in a north-central Oklahoma study, found that populations of dickcissels (*Spiza americana*) and Bell's vireos (*Vireo belli*) were 50 percent lower on grazed than ungrazed lands. He believed that grazing reduced the number of suitable nesting sites. Smith (1940), in another Oklahoma study, found that in the mixed-grass prairie, birds quickly disappeared from overgrazed lands. Moderate grazing may improve habitat for the mountain plover (*Eupoda montana*).

In Saskatchewan, Maher (1973) found that four of the seven species that regularly breed in the grassland prefer ungrazed prairie. These were the Sprague's pipit, western meadowlark, savannah sparrow and Baird's sparrow. The three species more abundant in the grazed prairie were the horned lark, McCown's longspur (*Rhynchophanes mccownii*) and chestnut-collared longspur. Maher also found one of the highest breeding bird densities recorded in any treatment during the study on burned grassland during the second year following the burn.

Karuziak et al. (1977) in southeastern Alberta found that the species diversity of birds was greater on ungrazed and lightly grazed ranges and that these were preferred for early nesting habitat. Passerine species that preferred lightly grazed or ungrazed mixed prairie were Sprague's pipit, Baird's sparrow and grasshopper sparrow (*Ammodramus savannarum*). The horned lark preferred heavily grazed ranges while the meadowlark was unaffected by grazing.

Larsson (1969) studied birds on grazed wet-meadow habitats in southern Sweden and found that the number of breeding species was usually higher in ungrazed than grazed areas.

Dambach (1944) conducted a 10-year ecological study of grazed and ungrazed woodlands in northeastern Ohio. After 10 years, breeding birds were four times more abundant on the ungrazed than on the grazed woodlands and there was more diversity of bird species on the ungrazed area. Dambach also found only 61 kinds of vascular plants on the grazed area compared to 124 on the ungrazed area after 10 years. This diversity in the plant community likely contributed to the diversity of bird species.

Duebbert and Lokemoen (1977) reported on 38 American bittern (*Botaurus lentiginosus*) nests, 2 marsh hawk (*Circus cyaneus*) nests, and 6 short-eared owl (*Asio flammeus*) nests found in fields of undisturbed, tall, dense grass and legume vegetation on the Woodworth Study Area in North Dakota. Data from 12 years of nesting studies on annually grazed grasslands in North Dakota indicated that American bitterns, marsh hawks, and short-eared owls did not use the grazed habitats for nesting.

We conclude that some species of nongame birds are adversely affected by grazing and haying, others are unaffected, and some benefit from these practices.

Vast acreages of grazed and hayed habitat are available on both private and public lands for those species which benefit from such practices. Habitat is more limited for species whose nest site requirements are not compatible with grazing and haying. Therefore, we suggest that management efforts on public wildlife lands should be directed to benefit species whose preferred habitats are not provided on most private or other public lands.

In summary of our literature review, there is general agreement that nesting ducks, upland game birds, and some other birds usually select the tallest and most dense residual vegetation available for nesting. There is strong evidence that nesting activity by some species is curtailed when habitat is annually grazed or hayed. Published results are variable about the effects of grazing and haying on nest success but more studies indicate negative than positive effects.

The next section of this paper is devoted to presenting data from studies of the relationship between the height-density of residual grassland vegetation and nesting activities of certain duck species.

### Woodworth Studies

#### Study Area

The 3,040 acre (1,231 ha) Woodworth Study Area was purchased as a waterfowl production area and is used by the Northern Prairie Wildlife Research Center for studies of relationships between land use and the production of waterfowl and other wildlife. It is in northwestern Stutsman County, North Dakota, within the Missouri Coteau physiographic region. There are 548 wetland basins that vary in size from a fraction of an acre to 53 acres (21.5 ha). Approximately two-thirds of the uplands are native mixed-grass prairie which have been invaded to varying degrees by Kentucky bluegrass (*Poa pratensis*), quackgrass (*Agropyron repens*), and smooth brome (*Bromus inermis*). More than 200 species of native and introduced plants have been identified on the upland portion of the study area. The remaining one-third of the uplands has a tillage history. About 84 acres (34 ha) are tilled annually under a rotational farming system. The remainder was seeded to various mixtures of grass and legumes including smooth brome, tall wheatgrass (*Agropyron elongatum*), intermediate wheatgrass (*A. intermedium*), crested wheatgrass (*A. cristatum*), alfalfa (*Medicago sativa*), and sweet clover (*Melilotus officinalis*).

#### Procedures

The height-density of residual vegetation was measured on 39 study plots during 1974-1976. Measurements were made by a slightly modified version of the method developed by Robel et al. (1970). One hundred measurements were made in each plot before new spring growth affected the physiognomy of the vegetation. Measurements were made along linear transects to determine the mean height-density of the residual vegetation. Plot size ranged from 12 to 129 acres (4.9 to 52.2 ha) and averaged 82 acres (33.2 ha).

The study plots were searched three times at about 21 day intervals during the nesting season from mid-May to early July. Nest searching was done between

7:00 a.m. and 1:00 p.m. with a 175 foot (53 m) cable-chain drag similar to that described by Higgins et al. (1977). All nests of ducks, upland game birds, shorebirds, wading birds, and raptors were marked for relocation. Ecological and egg data for each nest were recorded. Nests were revisited during subsequent searches or after the final search to determine fate. Additional data collected during these searches included records of upland game birds and deer flushed.

## Results and Discussion

The relationship between the mean height-density of residual grassland vegetation and duck nest density clearly demonstrates that female mallards, gadwalls, pintails, blue-winged teal, and northern shovelers (*Anas clypeata*) select fields of tall, dense residual grassland vegetation for nesting (Table 1).

The relationship between the height-density of residual grassland vegetation and duck nesting success indicates that observed duck nesting success is generally higher in the tallest and most dense vegetation (Table 2). Observed nesting success for individual species as related to the height-density of residual vegetation showed considerable variation. This variation is probably related to sample size and the fact that gadwalls begin nesting after new plant growth has changed the height and density of the vegetation. Our observations of duck nesting on grassland habitats in other parts of North Dakota, South Dakota, and Montana combined with our review of the literature convinces us that upland nesting ducks are selective for tall, dense grassland habitat for nesting, and that duck nesting success is generally higher in tall, dense grassland habitat than in other grassland habitats. We have not found grassland vegetation that was too tall and dense for use by nesting ducks nor have we found evidence that such conditions exist in the prairies.

Based on our studies, observations, and literature review, we recommend that the goal of grassland habitat management for upland nesting ducks should be to provide the tallest and most dense residual vegetation possible. In some areas, periodic manipulation to disrupt vegetative succession and restore vigor will be needed to maintain tall, dense, residual vegetation to accomplish these results. We suggest periodic treatments by prescribed burning, short-term heavy grazing, or mowing. Such treatment should be spaced as many years apart as possible while

Table 1. Relationship between the height-density of residual vegetation and duck nest densities, WSA, 1974-1976. There were 3,199 acres (1,295.6 ha) studied in 39 fields that ranged from 12 to 129 acres (4.9 to 52.2 ha) and averaged 82 acres (33.2 ha).

| Mean 100% visual<br>obstruction in<br>decimeters | Nests per 100 acres (40.5 ha) |         |         |                     |          | All  |
|--------------------------------------------------|-------------------------------|---------|---------|---------------------|----------|------|
|                                                  | Mallard                       | Gadwall | Pintail | Blue-winged<br>teal | Shoveler |      |
| 0.5-0.99                                         | 0.3                           | 2.3     | 0.3     | 11.4                | 0.7      | 15.3 |
| 1.0-1.49                                         | 1.5                           | 1.9     | 0.7     | 15.3                | 0.7      | 20.3 |
| 1.5-1.99                                         | 3.2                           | 5.8     | 1.6     | 13.5                | 0.8      | 25.1 |
| 2.0-2.49                                         | 2.8                           | 5.6     | 2.8     | 17.5                | 1.5      | 30.4 |
| 2.5 or >                                         | 4.1                           | 10.8    | 2.0     | 20.4                | 1.6      | 39.1 |
| No. of Nests                                     | 57                            | 127     | 35      | 449                 | 29       | 697  |

Table 2. Relationship between the height-density of residual vegetation and duck nesting success, WSA, 1974-1976.

| Mean 100% visual obstruction in decimeters | Observed nest Success (%) |         |         |                  |          |     |
|--------------------------------------------|---------------------------|---------|---------|------------------|----------|-----|
|                                            | Mallard                   | Gadwall | Pintail | Blue-winged teal | Shoveler | All |
| 0.5-1.49                                   | 25                        | 29      | 50      | 29               | 19       | 29  |
| 1.5-2.49                                   | 57                        | 48      | 45      | 25               | 60       | 35  |
| 2.5 or >                                   | 67                        | 33      | 67      | 48               | 33       | 45  |
| No. of Nests                               | 29                        | 113     | 24      | 378              | 33       | 573 |

still maintaining near maximum amounts of residual vegetation. Disturbances should be accomplished in as short a time as possible in the treatment year to minimize disruptive effects on nesting ducks and other wildlife.

Preliminary results from studies at Woodworth indicate that mixed grass prairie managed by prescribed burning produces taller and more dense residual vegetation than untreated or annually grazed mixed grass prairie. The highest duck nest densities observed in prairie habitat at Woodworth have been on prescribed burn plots, and observed duck nest success has been generally higher on the prescribed burned prairie units. We, therefore, recommend that prescribed burning be given strong consideration as a grassland manipulative tool on areas managed for nesting ducks.

We recognize that the potential for producing vegetation varies over the geographic range of nesting ducks and that this potential varies locally because of variations of soils, sites, and climatic conditions. Therefore, we have not attempted to set numerical vegetative height-density goals for management over the wide geographic range of upland nesting dabbling ducks. However, from a synthesis of available information it should be possible to formulate management regimes to maintain the long-term ecological integrity of grasslands for upland nesting ducks.

### General Summary and Conclusions

Higher densities of dabbling duck and upland game bird nests were usually found in undisturbed vegetation than in adjacent habitats that were annually grazed or hayed. Often a disproportionately large number of nests were aggregated in relatively small units of undisturbed habitat. In many situations, nesting success was higher in undisturbed cover but this pattern was not as clear as for nest density.

The strong relationship between higher nest densities and undisturbed cover is clearly related to the presence of residual vegetation of sufficient height and density to attract nesting hens. Therefore, cover management programs that remove all or part of the vegetation annually would be expected to have an adverse effect on these upland nesting birds.

We believe there is strong evidence that annual grazing or haying should not be allowed on habitats where maintenance of attractive and relatively secure nesting

cover is a management goal. On the other hand, there is evidence that many habitats cannot be maintained in long-term high vegetative condition without periodic disturbance. The need for disturbance is related to the balance between accumulation and decomposition of litter (Dyksterhuis and Schmutz 1947). According to the present state of knowledge, it is often difficult to prescribe how habitats should be treated and the frequency of treatment. We prefer the use of fire or grazing rather than mowing as a technique to manipulate vegetation. In general, frequency of treatment is related to productivity of the site. For example, areas of tall-grass prairie on fertile soils in the 20 to 30-inch precipitation zone in Minnesota may require treatment every 2 to 4 years. In a more xeric mixed-grass prairie in western North Dakota where annual precipitation is 12 to 15-inches, it may be possible to leave upland vegetation undisturbed for much longer periods. Xeric desert or semidesert grasslands may never require treatment. In most areas, the basic guideline should be to apply treatments just often enough to maintain the mean height and density of residual grassland vegetation at or near maximum levels for the site. Another factor that would influence the method and timing of treatment is the condition of the habitat when management is applied. Unfortunately, many of the habitats on wildlife management areas are in a degraded condition because of previous mismanagement and invasion of undesirable vegetation. Thus, a period of restoration management may be required before maintenance management can be practiced.

Some comparisons can be made between grassland management for livestock production and for wildlife production. For livestock, grazing is usually the dominant practice with at most only small areas remaining ungrazed. Conversely, to maintain optimal habitats for most upland nesting birds, it would be desirable to maintain a large percentage of the total habitat in an undisturbed condition.

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